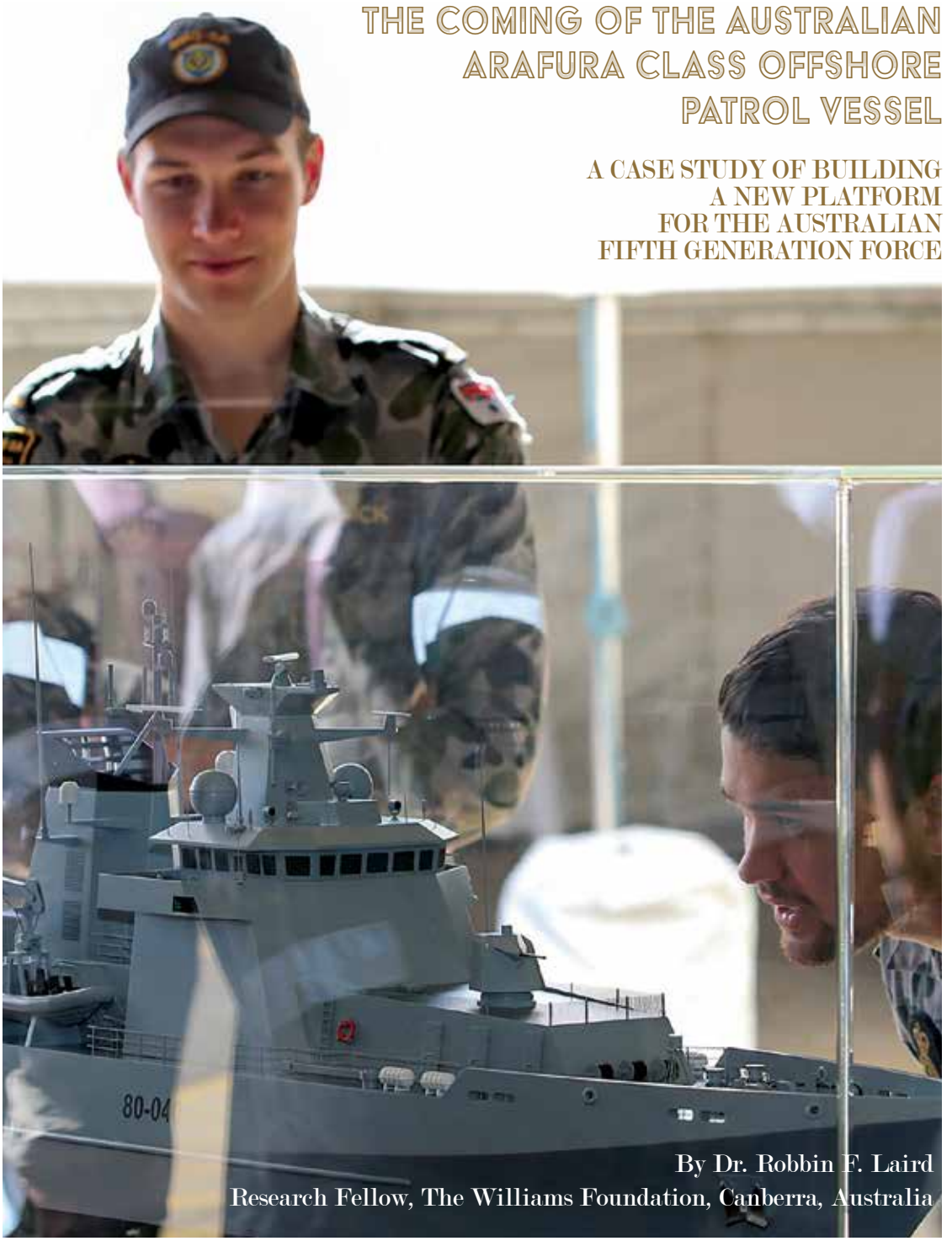
APRIL 2020

THE COMING OF THE AUSTRALIAN ARAFURA CLASS OFFSHORE PATROL VESSEL

A CASE STUDY OF BUILDING A NEW PLATFORM FOR THE AUSTRALIAN FIFTH GENERATION FORCE



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SEA1180 Offshore Patrol Vessel Program

DIMENSIONS:
Length — 80 metres
Beam — 13 metres

DISPLACEMENT:
1640 tonnes

PROPULSION:
2 Diesel Engines

SPEED:
Speed — 20 knots +

RANGE:
4,000 nautical miles

WEAPONS:
40mm Gun
2 x 50 Cal. Machine Guns

SEA BOATS:
2 x 8.5 metre side launched
1 x 10.5 metre stern launched

SENSORS:
Electro Optical Sensors
Electronic Warfare Systems
2D Radar
UAV Capable

C2 AND COMMS:
SAAB and L3

ACCOMMODATION:
40 crew with accommodation and services for up to 60

Australian Government
Department of Defence

LÜRSSEN

CIVMEC

ASC

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When I first came to Australia in 2014, I was asked to write a report for the Williams Foundation on their seminar on the evolution of airpower, which focused in a significant way on the coming of fifth generation aircraft and their impact on airpower modernization. During my most recent visit to Australia in March 2020, the seminar was to be on next generation autonomous systems, but that seminar has been postponed until later this year.

My other objective during the visit was to work on the topic of this report, namely the coming of the Arafura Class Offshore Patrol Vessel as a template of change for the Royal Australian Navy and the Australian Defence Force.

From the F-35 to working on the new build OPV may seem a strange journey, but the connectors were set in place during the several years of Williams Seminars in which I participated and have written the reports. Over the past several years, the focus of attention broadened from air power per se to the process of transformation of the Australian Defence Force (ADF), and the shaping of what has been referred to as the process of building a fifth generation ADF.

The focus has expanded to a broader pro-

INTRODUCTION

cess of transformation, enabled by the coming of the F-35 and associated processes of change. For the Royal Australian Navy, this process of change has been upon what the former Chief of Navy, Vice Admiral (Retired) Tim Barrett has referred as building not just an integrated navy but a navy able to contribute significantly to an integrated ADF.

During his presentation at the August 2016 Williams Foundation on air—sea integration, the Chief of Navy argued that "*we are not building an interoperable navy; we are building an integrated force for the Australian Defence Force*." He drove home the point that ADF integration was crucial in order for the ADF to support government objectives in the region and beyond and to provide for a force capable of decisive lethality.

By so doing, Australia would have a force equally useful in coalition operations in which distributed lethality was the operational objective. The Australian military is shaping a transformed military force, one built around new platforms but ones that operate in a joint manner in an extended battlespace.

They also recognize a key reality of 21st cen-

tury military evolution in terms of shaping an integrated information-based operating force. Interactive modernization of the force is built around decision-making superiority and that will come with an effective information dominant force.

The goal was put clearly by Air Commodore Craig Heap, then commander of the Surveillance and Response Group in the Royal Australian Air Force, in an interview:

"*We are small but we want to be capable of being a little Tasmanian Devil that you don't want to play with because if you come at us, were going to give you a seriously hard time that will probably not be worth the effort; deterrence in its purest form.*"

To achieve the goals identified by Vice Admiral (Retired) Barrett, a new shipbuilding approach has been envisaged to shape the capabilities which an integratable force would need to have going forward. Several new platforms emerged from the commitments of the Australian government in 2016, namely, a new Offshore Patrol vessel, a new ASW Frigate and a new build submarine.

Just listing these three ships would in the normal course of affairs appear to be three platforms, which would be built sequentially but with separate tasks, missions and hull forms. But the continuous shipbuilding approach articulated at the time of launching these projects has a more ambitious goal – linking these builds into a continuous modernization process in which integratability is a core outcome of the evolving force.

The Arafura Class Offshore Patrol Vessel is the first of the new build platforms. It provides the template with regard to the entire reset of how the Australians are seeking to build out their integrated distributed force. I decided during my visit last October 2019 that a case study of the OPV focusing on how the government, the services and industry were putting in place a template of change would provide insights into how the Aussies are working to realize this vision.

Vice Admiral (Retired) Barrett, now on the board of the Williams Foundation, agreed to help set up meetings and visits to support such a project.

During my recent visit in March 2020, I was able to hold the visits and interviews crucial to the project. The report reflects my findings and draws as well upon other visits in the past to Sydney, Canberra, and Adelaide as well. The contours of the new template are in place and can be identified and this report provides an initial identification and assessment of the new approach.

The new build OPV is not just a new platform; it is the spearhead of a new approach. And that approach as well as the OPV template is the focus of this report.

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>
> ***Air Commodore Craig Heap,***
> *Commander of the Surveillance and Response Group in the Royal Australian Air Force*

The Arafura class offshore patrol vessels (OPV) are being built for the Royal Australian Navy (RAN). The new OPVs are intended to replace the existing Armidale class and Cape class patrol boats, Huon class coastal minehunters, and Leeuwin class survey ships in service with the RAN.

The program is building a single class of ships to perform the functions of four legacy ships. This has its challenges, notably in terms of ensuring that the ships can be configured for the different missions, but the advantages of a common build of a class of ships in terms of manufacturing, sustainability and possibilities for export are obvious.

The OPVs in the class will be able to perform maritime patrol, response duties, and constabulary missions.

The Royal Australian Navy on the Arafura Class OPVs

Australia's current Armidale class and Cape class patrol boats are planned to be replaced with a single class of Offshore Patrol Vessel (OPV), under Project SEA 1180 Phase 1, to be built in Australia by German shipbuilder, Lürssen's subsidiary, Luerssen Australia partnering with Australian shipbuilder, Civmec in the joint venture, Australian Maritime Shipbuilding & Export Group (AMSEG).

The twelve Australian vessels are based on the PV80 design with the first two vessels to be built at ASC's Osborne ship yard in South Australia before production moves to Civmec's Henderson ship yard in Western Australia.

On 15 November 2018, the Chief of Navy, VADM Mike Noonan, announced that the OPV will be known as the Arafura Class with construction commencing at the Osborne ship yard.

The primary role of the OPV will be to undertake constabulary missions, maritime patrol and response duties. State of the art sensors as well as command and communication systems will allow the OPVs to operate alongside Australian Border Force vessels, other Australian Defence Force units and other regional partners.

The OPV design will support specialist mission packages, such as a maritime tactical unmanned aerial system, and into the future, rapid environmental assessment and deployable mine counter measure capabilities.

The lead vessel, HMAS Arafura is planned to enter service in 2021.

Source: https://www.navy.gov.au/fleet/ships-boats-craft/future/opv

The vessels can be customized to perform mine hunting, hydrographic survey, fisheries patrol, disaster relief, and unmanned aerial system (UAS) missions.

The Arafura class vessels will be interoperable with the fleet of Australian Border Force, Australian Defence Force units, and other regional partners to perform a range of missions.

Following the build of the first two vessels in South Australia, the next 10 vessels will be built at the new shipbuilding facility in Henderson, Western Australia.

The OPV project is the first of the new shipbuilding projects to be built under the framework of a "continuous shipbuilding approach."

"... A CONTINUOUS SHIPBUILDING APPROACH ..."

Auditor General Report on the Australian Offshore Patrol Vessel Project 2018-2019

The Australian Government's Auditor General provided their overview on the new Australian Offshore Patrol Vessel project in 2019. In the report, the challenge facing the builders revolving around the Australian workforce was highlighted. This is certainly why the build team was constructed the way it was with partnering between a ship builder and an Australian-based engineering company with significant experience throughout Australia on build projects. This is how the report highlighted the challenge:

"*There is a chance that the Arafura Class OPV production will be affected by demands on the available workforce leading to an impact on quality and schedule. The cause of this risk is the limited resources shared across the Continuous Naval Shipbuilding program. It is also caused by competition with competing Industries. The Naval Shipbuilding College is identifying the increased demands and skillsets required.*"

The overview to the review is as follows:

"*The SEA 1180 Phase 1 Offshore Patrol Vessel (OPV) Project will acquire 12 OPVs to replace the existing Armidale Class Patrol Boats (ACPB). The primary role of the Arafura OPV is constabulary operations and each ship will carry two cranes launched 8.5m Rigid Hull Inflatable Boats (RHIB) and one 10.5m Rapid Intercept Craft (RIC) launched via the stern of the vessel.*

In August 2015, the Government announced that SEA 1180 Phase 1 would become part of the continuous naval shipbuilding program and brought forward the construction of the OPV by two years to enable the start of the naval shipbuilding program by 2018.

In September 2015, the Government approved funding for the commencement of the Competitive Evaluation Process (CEP) for SEA1180 Phase 1. Interim Pass Project Approval was provided by Government in November 2015 and First Pass Approval was provided in April 2016.

The CEP consisted of an Analysis of Alternatives, a Risk Reduction Design Study (RRDS), a Request for Tender and an Offer Definition Improvement Activity. The Government also announced at First Pass that OPV designs from Damen (Netherlands), Fassmer (Germany) and Luerssen (Germany) had been shortlisted for the RRDS. Furthermore, the Government stated the first two OPVs would be built in Adelaide (Osborne Naval Shipyard) from 2018 and then transfer to Western Australia (Henderson Maritime Precinct in 2020.

The Request for Tender was released in November 2016. Upgrade of the Osborne Naval Shipyard was announced by the Government in December 2016. The CEP culminated with the Government announcing Luerssen as the preferred tenderer on 24 November 2017. The Government also announced that ASC Shipbuilding would be utilised for the first two OPVs and that the capabilities of Austal and Civmec would be used to build ten OPVs subject to the conclusion of commercial negotiations between Luerssen and Austal.

The contract for the construction of 12 OPVs was signed with Luerssen Australia on 31 January 2018. Luerssen nominated Civmec to construct the remaining ten OPVs and contracted Civmec initially to acquire and prepare the steel and pipe for all 12 OPVs from Australian sources (where available). Luerssen also established contracts with L3 Communications as a systems integrator and Saab Australia for a Situational Awareness System. The Commonwealth elected to purchase the RHIBs and RICs based on Luerssen's OPV design directly from Boomeranger.

To reduce the risk associated with commencing construction, the OPV Platform System was divided into two platform design streams (Stream A and B) and design streams for major subsystems, the Situational Awareness System and the Communication and Navigation System. Stream A consisted of the six keel blocks of the ship's hull which represented the high maturity of design enabling production to commence.

Stream A was subject to a design and production readiness review process enabling construction to commence on schedule. Stream B are the remaining blocks which comprise the remainder of the OPV Platform.

The internal components of these blocks were subject to some design change to accommodate those aspects of the OPV design that were modified to comply with Australian Government legislation or to meet Navy's requirements for commonality or interoperability with other Australian Defence Force units.

The OPV Situational Awareness System includes a version of the Saab 9LV Combat System. The sensors and weapons to be integrated include a 2D radar, 40mm Gun, an Electro Optical Surveillance System, Electro Optical Device and Electronic Support Measures.

The OPV Communication and Navigation System (CNS) includes an integrated electronic navigation system, internal and external communications systems such as Satellite Communication (SATCOM), Maritime Tactical Wide Area Network (MTWAN) and High Data Rate Line of Sight (HDRLoS) capability.

The ship will also have an Integrated Platform Monitoring System. The Support System is based on new analysis built from a combination of new and existing support data. For that reason, it lags the development of the Platform System. CCP 007 will adjust the Support System development and also introduce a Whole of Ship Design Review enabling completion of the design phase.

The construction of the first OPV commenced on schedule in November 2018 in South Australia at which time the ships were announced as the Arafura Class. The contracted keel laying milestone for OPV 1 was achieved in February 2019 and the ceremony for Nuship Arafura occurred on 10 May 2019. Production of the second OPV commenced in June 2019, two months ahead of schedule.

Nuship Arafura is expected to be delivered by Luerssen in December 2021 after which Navy will commence its Naval Operational Test and Evaluation (NOTE). Initial Operational Capability (IOC) is expected by December 2022."

Source: https://www.anao.gov.au/sites/default/files/Auditor-General_Report_2018-2019_19_0.pdf

Industry and the Australian Arafura Class Patrol Vessel: The Role of Luerssen

During my visit to Luerssen at the Henderson Shipyard, I met with Enrico Kestel, SEA1180 (OPV) Training Manager and Mick Handcock, SEA1180 (OPV) Senior ILS engineer. While I am not going to quote them directly, I will highlight takeaways I had from our conversations, my visits in Perth and Canberra, and my review of public statements, press releases and articles by other analysts of the program.

The first key takeaway is that the major challenge facing Luerssen is that it is both responsible for delivering the program to the Commonwealth and is also engaged in setting up a company in Australia. Lürssen is an integrated shipyard in Bremen, Germany with habitual working relationships with their suppliers; in Australia, Luerssen is taking the Germany expertise in design and build and applying it to Australia but working with a new group of suppliers to shape the new build process in Australia.

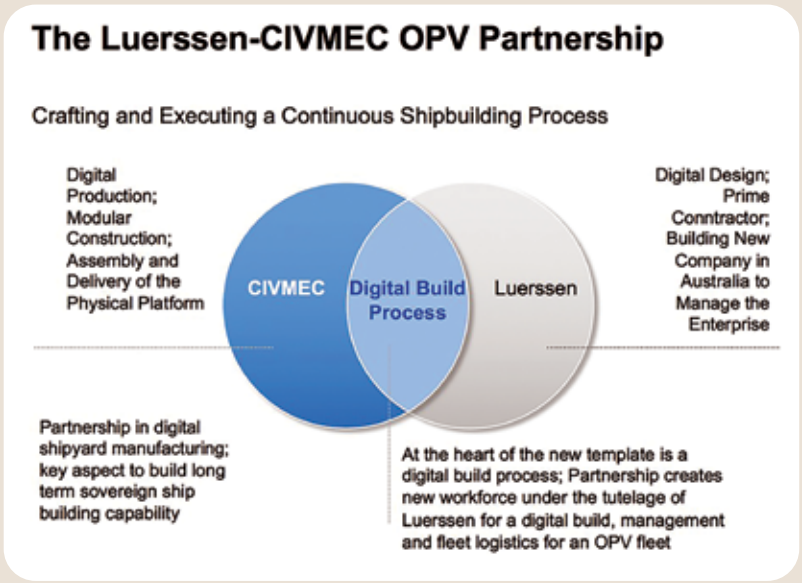
The second key takeaway is that it is a new build process. It is a digital design and build process.The design is worked in Bremen, reviewed and confirmed by Luerssen Australia at the build site which for the first two OPV's is being done at the BAE/ASC Adelaide yard at Osborne.

When I visited the CIVMEC facilities in Henderson, one could see the digital process in operation, where the robots under the supervision of the CIVMEC team were translating design to production. A key advantage of this process is that the production process clearly identifies where the parts being fabricated have come from, up to and including the suppliers. This leads to a significant quality increase as there is

THE HENDERSON SHIPYARD

The partnership between Luerssen and CIVMEC is at the heart of the platform build for the Arafura Class OPVs. To get an update on the joint venture, I visited the Henderson shipyard during the week of March 8, 2020.

During my visit to the Henderson shipyards, I met with Luerssen and CIVMEC, the two partners in the Australian Maritime Shipbuilding and Export Group (AMSEG).



This graphic is a conceptualization of how one might look at the partnership between Luerssen and CIVMEC and the roles and interactive relationship between the two partners. This working relationship is clearly a partnership, a point which was emphasized throughout my visit to Henderson. It was highlighted as a collaborative, close, mutually shared objectives partnering approach for the partners.

transparency through the digital build process.

In fact, Vice Admiral (Retired) Tim Barrett underscored the importance of the new process for the shipbuilding approach being put in place: "*The Luerssen -CIVMEC partnership is meant to create a new workforce under the tutelage of Luerssen (particularly in manufacturing in digital shipyards) rather than merely compete for an existing (pre-digital) workforce. This is an important feature in a long-term sovereign ship building capability.*"

The third takeaway is that an ongoing dialogue between Luerssen and the team in the Department of Defence working OPV is absolutely crucial to the effort. And in Bremen, there are members of the Australian OPV team as well working directly with the design side of the build process. It is clearly crucial to align expectations on the project for both industry and the government, and the team talks multiple times daily with regard to the ongoing effort. In my words, what is crucial for success with the new approach is "expectation management," rather than having a requirements list operating as a sledgehammer by government to gain industry compliance. It is a very different process if one wants to build a ship which is delivering capabilities for a concept of operations; rather than building a platform to a narrow set of pre-set requirements.

The fourth takeaway is that for the German company, it is operating in Germany with an Industry 4.0 process which is how the digital build and sustainment process is then realized. For this to work effectively, all of the suppliers as well as Lürssen must have the proper data flowing through the system to ensure the kind of accuracy and predictability of the build understood as a workflow process.

A challenge in Australia will be for Luerssen Australia and the Commonwealth to have a supply chain that can operate at Industry 4.0 standards and provide the flow of the quality and reliability of the data required to shape an effective build process flowing into the integrated logistics process as well.

This clearly is a work in progress. For the launch of the contract, the Commonwealth mandated a set of key suppliers, but in managing these suppliers and adding other Australian SMEs, Luerssen works a proposal to the Commonwealth with regard to vendors and terms of working with the vendors, and the Commonwealth then makes a decision for Luerssen to implement.

The tender for the Capability Life Cycle Manager (CLCM) role within what is termed the OPV Enterprise, essentially the combined Government and industry "sustainment team," has just been released. An industry day was scheduled to be held on March 16, 2020 but was postponed due to the coronavirus impact. But given the nature of the very different build process, it is clear that the approach to logistics will be shaped differently as well from a legacy shipbuilding process. A key aspect of the ILS solution set will be to craft a fleet wide logistics solution for the OPV over the full Life of Type (LOT) up to and including disposal of the fleet.

How this will be done is a work in progress, and a significant aspect of the program going forward, but clearly, getting the work process data flow right in the build process will facilitate getting the work process data flow for sustainability right as well. And that is a key part of the new approach associated with "continuous shipbuilding." It is not just about a build; it is about having a sustainable fleet built around a digitally upgradeable ship.

This table, which comes from the SEA 1180 Phase 1 Offshore Patrol Vessel Public Plan published in October 2018, identifies the key suppliers in the OPV project.

Table 1: Companies supplying major products and services to Luerssen under this contract

Vendor/Supplier	Product/Service	Locality
ASC OPV Shipbuilder Pty Ltd	Ship building services including the placement of sub-contracts for supply of materials, fittings, equipment and services	Osborne, SA
Civmec Construction & Engineering Pty Ltd	Ship building services including the placement of sub-contracts for supply of materials, fittings, equipment and services	Henderson, WA
Saab Australia Pty Ltd	Supply of Situational Awareness System and associated combat system software and hardware including the placement of sub-contracts for supply of materials, fittings, equipment and services	Mawson Lakes, SA
L3 Communications Australia Pty Ltd	Supply of Integrated Platform Management System and associated communications system software and hardware including the placement of sub-contracts for supply of materials, fittings, equipment and services	South Wharf, VIC
Penske Power Systems Pty Ltd	Supply of MTU engines and xx including the placement of sub-contracts for supply of materials, fittings, equipment and services	NSW
Taylor Bros. Marine Pty Ltd	Outfitting materials and services including the placement of sub-contracts for supply of materials, fittings, equipment and services	Derwent Park, TAS
Noske-Kaeser Marine Australia Pty Ltd	Supply of HVAC system, CO2 firefighting system, Refrigeration and Chilled water systems, including the placement of sub-	Drummoyne, NSW

SEA 1180 Phase 1 Offshore Patrol Vessel Public Plan published in October 2018 (abstract)

"Luerssen Australia Pty Ltd, an exciting new entrant to the Australian defence industry landscape, is contracted by the Commonwealth of Australia (Commonwealth) as the Prime Contractor responsible for building 12 Offshore Patrol Vessels for the RAN. Construction will start in November 2018 and is expected to be completed around 2029/2030.

Luerssen is a subsidiary of a long established and successful shipbuilding group in Germany and it will quickly build its capabilities and staff in both Adelaide, SA, and Henderson, WA, to establish fully operational program management, support and engineering design capability. Luerssen has selected as its shipbuilding sub-contractors two key industry players which will offer maximum Australian involvement:

ASC OPV Shipbuilder Pty Ltd which will build the first 2 OPVs in Osborne, South Australia, and Civmec Construction & Engineering Pty Ltd, located in Henderson, Western Australia, where they will build the next 10 OPVs.

The current total contract value (until 2030) is $1,988 million expressed in constant year dollars exclusive of GST or $2,570 million expressed in out-turned year dollars exclusive of GST.

The portion representing Australian contract expenditure is currently estimated (prior to all sub-contracts being finalised) at $1,220 million in constant year dollars exclusive of GST. The AIC value has potential to grow as the program proceeds including opportunities to increase Australian industry participation linked with design reviews at ships 3, 6 and 9.

Luerssen has contracted with the major subcontractors identified in the table below to manage the majority of construction and supply activities associated with the program.

In addition to these shipbuilders Luerssen will directly engage a number of Australian companies including many Small to Medium Enterprises (SMEs) to perform work under the contract. The scope of work to be performed by these companies includes manufacturing, logistics, engineering services, project management, supply of specialist equipment items and provision of contract labour supporting contract deliverable activities."

Industry and the Australian Arafura Class Offshore Patrol Vessel: The Role of CIVMEC

When I first learned that Civmec was going to be the major build partner of Luerssen, I must admit that I was a bit surprised: Civmec is a shipbuilder? Clearly, they are a major Australian company in building infrastructure, and in steel production, but certainly, they are not a household name in shipbuilding.

But since my original reactions, I along with the Australian public have begun to learn more about the company and what they do and how they work.

With my visit to Henderson, I was able to talk with two senior Civmec officials as well as to review the public information provided by the company to sort through who they are, what they are doing, and why selecting them as the build partner for Luerssen made a great deal of sense.

During my visit, I met with Jim Fitzgerald, Executive Chairman of Civmec, and with Mark Clay, Project Manager, formerly of Austal and now with Civmec. I am not going to quote them directly,

but highlight my key takeaways from my search of the public available data, discussions held in Perth, Adelaide, Canberra and Sydney with Royal Australian Navy and Commonwealth officials, and my meetings at Henderson.

The first key takeaway was my having missed the core competence of the company in plain view. It is clear that in my initial read of the Civmec choice, I had missed one major area in which they work which is central to shipbuilding; they are players in the oil and gas offshore platform business. These are certainly sea bases and of relevance more generally to managing a shipbuilding enterprise.

A second key takeaway is the significant investment which Civmec made in shipbuilding PRIOR to the award of the OPV contract. Notably, in 2016 Civmec announced that the Company had executed an Asset Sales Agreement for the acquisition of Australia's largest privately-owned engineering and shipbuilding company, Forgacs.

Following the due diligence process and subsequent negotiations the company decided that the acquisition will include the Forgacs name, the shipyard facilities, and the assets located at Tomago, New South Wales...

This provided Civmec with a significant East Coast presence in the ship building and maintenance business as well as enhancing its overall portfolio in the maritime industry.

The third takeaway was provided by Jim Fitzgerald at the beginning of our session where he went through the transformation of the Henderson yard from 2009 to 2020.

In a May 26, 2018 press release, Luerssen provided an update on their partnership with CIVMEC.

" One of the world's leading shipbuilders, Luerssen, has teamed with Australian engineering and construction firm Civmec to create a new force in naval shipbuilding and exports.

The joint venture, Australian Maritime Shipbuilding & Export Group (AMSEG), will partner Luerssen Australia, the prime contractor and designer for the Australian Government's Offshore Patrol Vessel program, with West Australian-based Civmec, soon to list on the Australian Stock Exchange.

It is intended that AMSEG will play a significant role in the build of ten OPVs in Henderson, Western Australia and in driving an export shipbuilding business that will target opportunities around the region.

The joint venture will be chaired by one of the nation's foremost naval experts, former Chief of the Navy, Vice Admiral (ret) Chris Ritchie.

"This new company will be governed by an Australian board and operate under Australian management to build world class naval vessels in best practice Australian shipyards," Vice Admiral (ret) Ritchie said.

"We will invest in Australian skills and infrastructure and transfer expertise from SEA1180 prime, Luerssen Australia, to develop capability and support the foundation of a sustainable naval shipbuilding industry that is able to export to the global market."

With regard to the partnership, Luerssen Australia Pty Ltd is the prime contractor with the Commonwealth and CIVMEC is its WA based ship building partner. The AMSEG JV is focused in the short to medium term on sustainment activities and future builds outside of SEA1180."

His portfolio of photos highlighted the transformation of the yard through this 11-year period from a fairly limited facility to a much more robust infrastructure to support shipbuilding and maintenance.

He noted throughout that Civmec was investing in its future in the maritime business prior to and obviously after having received a contract to work on the new Australian OPV.

Just taking a look at three points in history - 2009, 2016, 2019 [*see photos page 10*] - at the yard certainly highlights the effort, and the commitment of Civmec to build a 21st century shipbuilding and maintenance facility.

The facility which I visited during the site tour is not only completed but went from flat ground to completion in only 18 months.

The fourth takeaway was that the build of the first two Arafura Class OPVs at the BAE/ASC yard in Adelaide was not taking away from the effort of Civmec for the overall program or its preparation to build the remaining ships in the program at Henderson.

The materials being cut to build the ship are being done at one facility, not two, and that facility was the one which I visited in Henderson. The material is shipped from Henderson to Adelaide by road and rail and given that the cost of transport West to East is significantly less than East to West, the cost factor of having the initial assembly in Adelaide rather than Henderson is very manageable.

This also allows the Henderson yard to have a two-ship run through prior to launching full production at Henderson.

This is a digital production facility which is clearly evident when you visit the cutting facilities at the yard, where precision is

the name of the game and where the production workers and staff are managing a digital production process. This includes having a control room which is monitoring the parts flows into the yard and working schedules that are designed that materials for production arrive just in time for the production process.

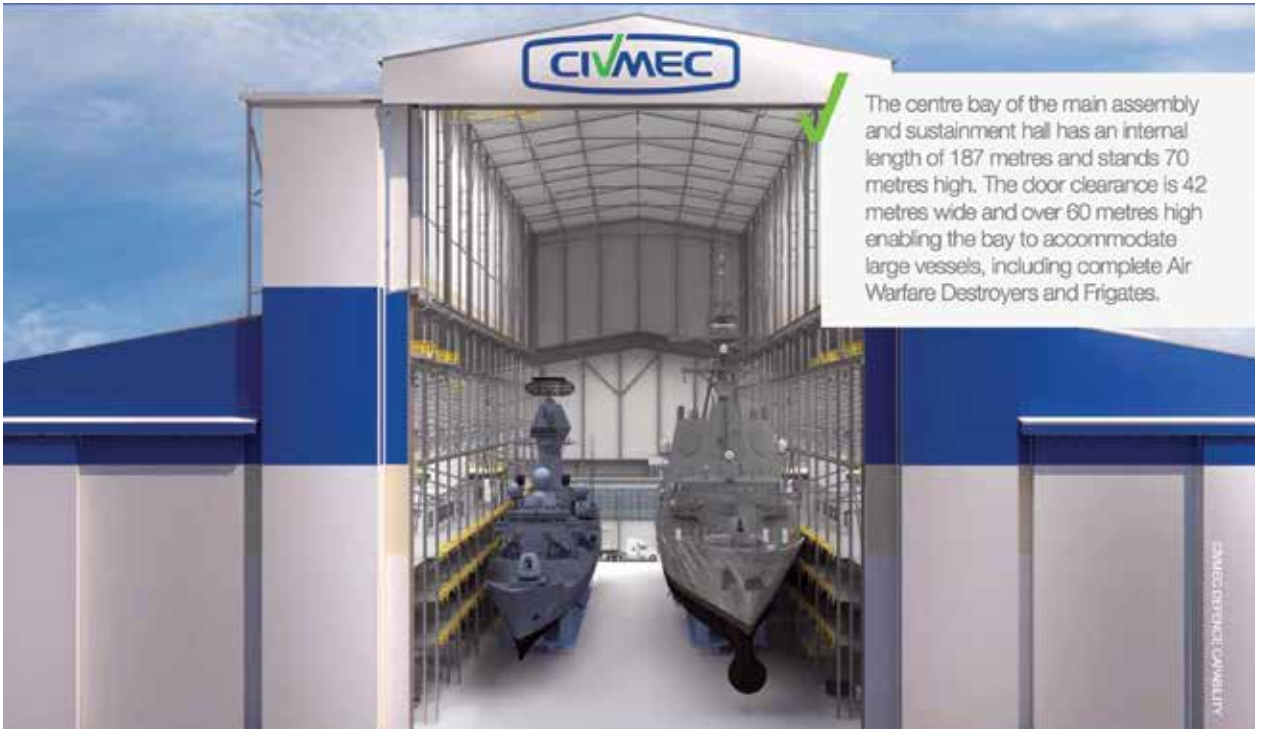
The fifth takeaway was that the yard had been built with a clear build process which could take the manufactured parts, work those into modules for the final assembly process, move those modules then into the paint and then assembly hall areas and then when the ship is completed over to the floating dock for final completion and acceptance. And this is done on the real estate of the single yard. The graphic on page 16 gives one the sense geographically of this workflow.

The sixth takeaway is that the main assembly and sustainment hall is massive and can accommodate the Royal Australian Navy's ship up to the size of the Air Warfare destroyer. The graphic below highlights the assembly hall.

This approach clearly meets the concept of how the Commonwealth wants to approach to future of sustainment of its fleet.

When at the Seapower Conference held in Sydney last Fall, I listened to a presentation by Rear Admiral Wendy Malcolm, Head of Maritime Systems Capability Acquisition and Sustainment Group. Rear Admiral Malcom highlighted the importance of ensuring that a new sustainment strategy be built into the build out of the next generation Australian navy.

She argued that the Australian government has committed itself to a step change in naval capability. Australia will be engaged in



the most significant recapitalization of its Navy since the Second World War.

"*We need to reshape the way we sustain our fleet as we go about a significant change in how we are doing Naval acquisition. As a result, we need to future proof our Navy so that it is capable and lethal and available when and where they are needed.*

"We need to build a sustainment model which ensures that we can do this as well."

Sustainment has been largely thought of as the afterthought to acquisition of a new platform. She argued that with the new "continuous shipbuilding approach" being worked, sustainment needs to be built in from the start into this process approach.

"*We should from the outset to consider the best ways to sustain the force and to do so with engagement with industry in the solutions from the outset.*"

She noted that the acquisition budget is roughly equivalent to the sustainment budget, and this means that a new approach to sustainment needs to accompany the new acquisition approach from the outset to ensure the delivery and operations of the most lethal and capable combat fleet which Australia can provide.

"*There are serious external and internal forces that are forcing change in our thinking about how we will use our fleet. A major investment in shipyards, work force, and in new ships requires an appropriate sustainment approach to deliver the capability to do the tasks our navy is and will be required to do.*"

The shift to "continuous ship building" entails a major change in how Australia needs to think about sustainment as well. She argued that a number of technologies had emerged which allow from a more flexible and adaptative way not only to build but to sustain ships as well.

"*We need to take a fleet view and to shape a continuous approach to sustainment as well.*"

Rear Admiral Malcolm dubbed the new approach of a continuous sustainment approach or environment as Plan Galileo. Clearly, Civmec is ready for Plan Galileo.

The seventh takeaway is that Civmec is well positioned for digital shipbuilding and sustainment for as early as 2012 they had introduced an information management system which is a clear foundation to support a digital approach. This system is called "CIVTRAC".

In short, Civmec has put in place a capability to engage in and support the "continuous shipbuilding approach."

Prime Minister Scott Morrison visits Henderson Shipyard on October 3rd, 2018 © CIVMEC

CIVTRAC,
AN INTEGRATED BUSINESS MANAGEMENT SYSTEM FOR 'LIVE TRACKING'
(Abstract from the CIVMEC brochure)

" We are certified to ISO 9001, the internationally recognised standard for quality management, and our heavy engineering facilities have also achieved CC3 certification to the requirements of AS/NZS 5131-2016. We have also obtained certification to ISO 3834.2:2008 – Quality requirements for fusion welding of metallic materials (Part 2: Comprehensive quality requirements).

Utilising Civtrac, our proprietary web-based integrated business management system, we are able to accurately provide 'live' tracking, managing all aspects of project delivery, including:

- *Document Control*
- *Material Control*
- *Project Management and Reporting*
- *Safety Management*
- *Quality Control*
- *Cost Management*

With 3D model interface, the productivity tracking, quality control and completion management activities undertaken in the field, recorded on tablets in real-time, facilitate Civtrac's seamless flow from fabrication through to installation and commissioning.

Civtrac also enables our clients to directly monitor real-time progress via a remote login, providing transparency across the entire project life-cycle, from material control to delivery and installation."

GOVERNMENT PERSPECTIVES

N.B. : During my March 2020 visit, I was able to talk with the key government team managing the OPV project. Earlier, I had several opportunities to discuss the OPV project with the head of the Maritime Border Command, Rear Admiral Goddard, whose Command will be a major user of the vessel and whose integrated approach to working security and defense is a driver for the kind of integratable systems onboard the vessel.

We were scheduled to meet during the March visit but the challenge of dealing with Coronavirus crisis postponed our meeting during this visit as well as defining my departure point from Australia during the visit.

The Australian Government and the Australian Arafura Class Offshore Patrol Vessel: The Perspective of the Royal Australian Navy (RAN) and Capability Acquisition and Sustainment Group (CASG)

After my visit to Perth and the Henderson Shipyard, I had a chance in Canberra to discuss the new class of OPVs with the senior leadership team in Navy and the Capability Acquisition and Sustainment Group (CASG) within the Australian Department of Defence.

Participating in the discussion were Peter Croser, who is the Canberra based CASG Assistant Secretary Ship Acquisition – Specialist Ships responsible for the projects SEA1654 AOR's, SEA1180 OPV's, SEA2048 Phase 4 LHD's, SEA2048 Phase 3 LLC's and SEA3035 simulators for the RAN; Commodore Chris Smith (Director General Littoral), and Commander Gavin Baker (Deputy Director Patrol Force.

As I have done with the meetings with Luerssen Australia and CIVMEC, I will highlight takeaways from our discussion rather than directly quoting comments by participants. These takeaways are also based on the past two years of discussions I have had in Sydney, Adelaide, Perth and Canberra about the new continuous shipbuilding approach.

The first takeaway is that clearly the Department is focusing on a new approach in launching this ship, but a new approach which is seen to provide a template for the way ahead.

It is not about simply having a one-off platform innovation process; it is about launching a new way of building this ship and in so doing setting in motion new ways to manage the initial build and the ongoing modernization process. It is not about having a "bespoke" platform; it is about shaping an approach that allows leveraging the systems onboard the new platform across

the entire fleet and Australian Defence Force modernization process.

In part, it is selecting a platform which physically can allow for the upgrade process envisaged with the new emphasis on a fleet mission systems management model. The Royal Australian Navy has clearly gone through a process of choosing a ship that has a lot of space, a lot of margins, the ability to adapt to missions by its space on deck, and under the deck for a modular or containerized solutions, extra power to operate for what comes in the future, and the ability to adapt the platform through further evolution of the design to take on different missions into the future.

The platform is important; but the focus is not on what the systems specific to the ship allow it to operate organically as an end in of itself but as part of wider operational integratable force.

The second key takeaway is that a core way to do this is to change the governance approach.

The new approach is one in which the platform-build and evolution is managed by one CASG team working interactively with another CASG team addressing the management of the mission systems. This comes together in an Integrated Project Team with Navy.

The platform-build and design refresh team are focused on building a ship which is capable enough at the outset to accommodate an upgrade process for the mission systems onboard the initial vessel and which is upgradeable over time.

The mission systems team which is working closely with the platform team is focused on shaping a mission systems capability which can be both tailored to the OPV but can be leveraged across the fleet for other platforms in the fleet over the new build and modernization process which the Royal Australian Navy is undergoing.

The approach to the new build OPV is that the ship is becoming the support for the mission systems which need to be rapidly and upgradeable over time. This means that the core capabilities of the ship need to have the physical qualities for adaptability in terms of size, power, and modular space to be able to accommodate mission system dynamics over time as well.

And the digital build process is crucial to ensuring that modifications can be made as well over time. Throughout the modernization process, it is envisaged that mods can be made to the ship which allows for the innovations which missions systems and associated capabilities can be added to the ship over time.

The third key takeaway is that such an approach also requires a new government-industrial working relationship.

Rather than contracting to a prime and establishing a set of requirements with which the prime is to comply in terms of the organic capabilities on that particular platform, the focus is upon an open-ended partnership. The government team working with Team Luerssen have shaped a collaborative environment which provides for a force multiplier of ideas.

The older prime contracting model focuses on setting requirements and ensuring they are met for the organic platform, and in such a setting industry would focus on selling a solution which is narrowly focused on meeting those requirements.

The fourth key takeaway is that what is being established is a shift from a platform specific set of requirements to be enforced through a contracting process to a concept of operations model.

How can the mission systems evolve on the ship working interactively with other platforms to deliver the effect desired from the program?

For example, rather than focusing on what the OPV will be able to contribute in terms of its organic systems onboard to deliver counter mine capabilities, the focus is on how the missions systems and maritime remote or autonomous systems onboard can work together with other relevant platforms to deliver an integrative effect to deliver the counter mine capability desired.

This is similar to what I discussed onboard the HMAS Rankin during my visit to Perth, where the evolution of the Collins class submarine in terms of systems which would then be transferrable to the new build class of submarines was really about reshaping what a wolfpack would be able to deliver in a distributed maritime integratable force.

Clearly, the notion of mission systems and their delivery of effect for the new OPV is not about what the vessel can do itself but how those mission systems can reach out into a combat cloud to deliver a broader effect through integratability with associated assets on other platforms, both air and sea, and land as well.

The fifth key takeaway is that the core focus on sovereignty has shifted from how many bolts can an Australian worker drive into a hull, to having ownership of the digital design and mission systems ongoing mission systems management process.

Clearly, Australia would face a continuous challenge to keep up with technology if the focus was upon every bit of technology needing to be built in Australia. By focusing on owning the evolving mission management capabilities, this allows the Australians to then be open to leveraging evolving allied technologies as well and working with partners to leverage that technology, but within an integratable Australian solution set.

The new OPV approach focuses upon an ability to adapt rapidly the mission control systems whether they be underwater or surface autonomous systems without having to go back to change the platform itself in order to do this.

For example, the Aussies are looking to adapt the platform to what the mission systems can do in terms of launch and recovery and the ability to have an appropriate flow of information in and out and to have the mission systems adapt very quickly both to technology, but operational experience and the shaping of broader wolfpack concepts of operations. They don't want to have the mission systems constrained by the platform itself because they clearly want to be able to move mission systems capabilities where appropriate across the fleet.

They clearly do not want to be constrained by what a single provider offers; they want to be able to work with a diversity of organizations to deliver the desired outcome. And this means that the mission management

system is at the center of the new sovereign approach.

In short, we are talking about a significant shift in how the Commonwealth intends to work with industry and to build integrative capabilities across its platforms.

This will be done through the mastery of the mission systems management process and ensuring that any new platforms are capable of both leveraging the achievements of the new build approach but also improving on it, and then having backward upgradeability to the "new" legacy fleet.

This is a major change; and it also is a major challenge. But without question it is setting the course of shipbuilding in a direction where building out an integrated distributed force is possible.

The Maritime Border Command: Concepts of Operations and the Coming of the Arafura Class Offshore Patrol Vessel

In my recent discussion with the CASG team in the Department of Defence managing the build of Arafura Class Offshore Patrol Vessel, a key point was that the new build ship was being designed to enable innovations in concepts of operations, rather than simply being built to a set of requirements for a particular class of vessel.

What is being established is a shift from a platform specific set of requirements to be enforced through a contracting process to a concept of operations model.

How can the mission systems evolve on the ship working interactively with other platforms deliver the effect desired from the program?

For example, rather than focusing on what the OPV will be able to contribute in terms of its organic systems onboard to deliver counter mine capabilities, the focus is on how the missions systems and maritime remote or autonomous systems onboard can work together with other relevant platforms to deliver an integrative effect to deliver the counter mine capability desired.

The synergy between the approach involved in the build of the OPV and that of the concepts of operations being exercised by and evolving with regard to the Maritime Border Command is significant.

The Maritime Border Command operates with a whole of government, integrated approach to dealing with its challenges. It requires an integrated approach to C2 and decision-making and provides a clear case of the most integrated force within the ADF/Government nexus. As a result, the coming of the OPV fits right into their approach, and will add integrative capabilities to their overall operational capabilities.

Within the Australian forces, the Maritime Border Command is a key example of what is seen as the kind of blended force able to operate in the gray zone which is suggestive of the ADF transformation as a whole.

Rear Admiral Goddard Speaks At The Williams Foundation Conference, October 2019

In my discussions with Rear Admiral Goddard, the head of the command, as well as his presentation at the Williams Seminar last Fall on Fifth Generation Maneouver, he discussed how the Maritime Border Command is structured to operate and in discussions with senior ADF after the seminar it is clear that this Command is a model of sorts with regard to the kind of integrated and tailorable force they view as needed to deal with regional dynamics.

The Maritime Border Command Rear Admiral Goddard's Presentation at the October 2019 Williams Foundation Seminar on Fifth Generation Manoeuvre

Maritime Border Command (MBC) as a multi-agency organization, is a blended Australian Border Force and Australian Defence Force Command. Our mission is to support a whole of government effort to protect Australia's national interests by responding with assigned forces to undertake civil maritime security operations to detect, deter, respond to and prevent illegal activities in the Australian Maritime Domain.

The civil maritime security mission is vast – and covers almost 11% of the earth's surface. It is a mission that the ADF nor ABF can achieve alone – and so my command is a practical example of integration of several arms of the Australian government. Through our capacity as a convening authority, at any point in time I can rely on ADF, AFP, AFMA, intelligence agency, AFP and others unified together for effect; a true Multi-Agency.

However, the advantages of this unity of effort must be leveraged ultimately at the tactical level, through what I would term Command and not control – Robbin Laird has termed control the 'legacy approach to hierarchical approval' and I would tend to agree with his assertion that any advantage on the battlefield we currently have would be negated by a hierarchical approach. MBC must take advantage of the opportunities afforded from a distributed force to achieve mission success through technological advantages – our future will be through allowing sound decision making at the tactical level through sound connectedness.

By virtue of the nature of the command, MBC is answerable to both the Home Affairs Portfolio and the Australian Defence Force through the Chief of Joint Operations. This in itself has the opportunity to create advantage for the civil maritime security mission; the advantage of operating in the so-called 'Grey Zone.' While MBC operations are civil in nature, it has a high-end mission – security of our maritime borders – and uses high-end assets to do so; an ideal future would to see the entire spectrum of both civilian and military assets put to the task.

Operating within this grey zone allows MBC to play a large role supporting and engaging a large remit of stakeholders. With regular contact with all facets of government from State/territory up to Commonwealth as well as industry in a supportive role, MBC's force elements encompass land, sea and air – a unique arrangement in regards civil maritime security, however Australia's Borders are unique which necessitate this approach. Reflecting a Fifth-Generation approach, the force is scalable dependent on the threat or response that is required and the structure at Maritime Border Command allows this force to fully integrate providing both situational awareness and effect.

Why do we need the flexibility such a force provides? Maritime Border Command is responsible for 8 Civil Maritime Security Threats; not all these threats represent what might be considered traditional Coast Guard functions, rather they embody Border threats across the spectrum of crime, violence, environment and exploitation. Piracy, robbery and violence at sea,

response to Oil Platform and illegal domestic activity in our marine parks might be three examples of Coast Guard like functions performed by MBC on any given day.

MBC – even with the combined force assigned elements at its disposal – cannot conduct this mission alone. It takes global partnerships and strong interagency co-operation and co-ordination.

Maritime Border Command's coordinating function is aimed to create time and space aiming to prevent crisis management. By way of example, in the counter narcotics space, MBC coordinates with the Australian Federal Police, Australia Criminal Intelligence Commission, AUSTRAC and State Police Forces as well as international agencies such as the United Nations Office of Drugs and Crime and the INTERPOL. Overseas national law enforcement agencies such as the US Drug Enforcement Administration and the UK's National Crime Agency not only provide valuable and timely intelligence, they also allow us to push our national border for narcotics importation far off shore.

The ability to create time and space beyond our physical national borders improves MBC's responsiveness within the SFAA and is only achievable through effective Maritime Domain Awareness. Technological improvements in platforms are only part of the picture for effective MDA – the platforms must be combined as a Joint effect and they must be interconnected – isolated pockets of effect will not only devalue the operating picture, such a limited focus may lead to decision making out of context with the wholistic picture; the veritable fog of war. Our collective mission through the Fifth Generation manoeuvre must be a forcing function to enable effective decision making though interconnectedness.

A unique environment – one that encompasses civil maritime security from the northern extremes to the southern, from some of the hottest to the coldest places on earth. The challenges transcend geography though, how to ensure the tactical elements are receiving real-time information which will maximise their effect? How to avoid paralysis through analysis and ensure effective identification of the threats within normal patterns-of-life? MBC examines a region of the world in which major shipping lanes traverse east-west, north-south and the volume is large – more than 20000 contacts per day.
A vast area to which, on a daily basis, sufficient surveillance to provide logical decisions as to force disposition and responses can be made.

To improve understanding, MBC relies on an effective and complex network of inter-agency interactions, a force-multiplier greater than MBC or its Force assigned elements alone. Government Policy as always is the driver supported through the Domestic and International Engagement. Awareness is achieved through wide information sharing; MBC continuously looks to foster relationships with like-minded organisations facing similar challenges where information sharing is mutually beneficial.

So to be effective in this massive area of the global commons MBC:

1. Seeks to push our national borders as far offshore as possible
2. Work with international agencies to ensure a global response to Maritime Security Threats
3. Develop and maintain a Common Operating picture covering our Maritime Domain to ensure we can identify and respond to threats well out to sea or be well prepared for their arrival in the littoral
4. Harnessed the resources of the ADF and ABF and other government agencies to maximize the surveillance and response options available to us.
5. Work closely with domestic agencies to ensure a robust response when threats arrive at the national border.

What of the future?

A healthy, open and accessible maritime environment is key to Australia's economy, security and culture. We expect that the maritime domain will become more interconnected than ever before.

Australia will have to consider ways and means to share information with regional partners more fulsomely, and more rapidly; if we are to truly support a regional surveillance and awareness effort. Current ways of sharing may not be flexible enough to meet our needs – our international engagement efforts in realising this are critical to shared situational awareness.

In summary, Maritime Border Commands effectiveness is reliant on building and maintaining strong relationships between a broad network of interagency stakeholders; government and industry. This provides me the assurance that I am achieving the level of situational understanding I require to achieve my mission.

The Building of the OPV as a Reflection of the New Approach

With this focus on building what I call an integrated distributed approach, it is clear that the ADF will address building many of its new platforms with regard to how they both contribute to and can benefit most from such a concept of operations.

The new Navy vessel the Offshore Patrol Vessel being built for the Australian Navy, with some of those vessels to be used by Maritime Border Command, is clearly a case in point, and one which if highlighted and studied carefully can provide a case study of the new approach which the Australians are taking with regard to both the integrated distributed force and the role which such a force needs to play in the region.

Rear Admiral Goddard noted during an interview last year that in the Australian Border Force headquarters, into which Maritime Border Command's headquarters is integrated, they have an operations floor on which the various security agencies involved in dealing with the spectrum of civil security operations work together to be able to support or direct operations at a distance dealing with a challenge coming from a regional or maritime source.

"*We have on the operations floor representatives of Australian Border Force, Maritime Border Command, Border Command, Customs, Immigration, the ADF, the AFP, intelligence agencies and members of five eyes, and together we work to tailor support to the particular challenge or problem.*"

He then discussed how the Command was looking forward to the future of the Offshore Patrol Vessel, which as a Navy asset (not a Maritime Border Command asset) will need to fit into this paradigm and provide the kind of operational capability looked for at sea.

In effect, the evolving C2 and ISR infrastructure being built at the Command aim to be configured to operate seamlessly with the systems which will be delivered on the OPV. This technology advantage should provide improved communications and real-time SA for the Command, improving the speed and quality of decision making for the command element onboard the OPV to make decisions at the tactical edge.

It is understood that the Navy is building in new capabilities onto the OPV which will allow it to work with a wide variety of assets, to be able to integrate capabilities for a solution on the fly, including the ability to communicate directly to partners operating ashore in their area of interest or with partner assets in the air or on the sea.

In effect, the Navy's new asset was being built fit for purpose, and in this case, it was building a capability able to deliver decision making at the tactical edge.

Thus, it is a microcosm of a broader set of changes occurring in the ADF which are often referred to as building a fifth-generation force. The OPV is being designed from the ground up with off-board systems and the new C2/ISR morphing infrastructure as key building blocks.

And given the modular flexibility associated with the ship and with the remote systems payloads, the OPV could be part of an amphibious task force, provide support to a destroyer task force, be a key command element for a gray zone operation, and so on. Because it is designed to be able to contribute to and to leverage offboard systems from the outset, it can be task organized beyond its core mission.

SHAPING A NEW BUILD PLATFORM FOR AN INTEGRATABLE FORCE

WHAT IS THE ROLE FOR SUPPLIERS?

This section of the report provides additional perspectives on the OPV new build project and how the approach being shaped is part of the wider ADF fifth generation approach. We start with addressing how the new approach for the prime contractor working with industry changes the role as well for suppliers to the project.

What is that new role?

And how does one key supplier, L3Harris address that role and focus on the integratable challenge?

A key trajectory for the shaping of effective full spectrum crisis management forces is enhancing the integratability of the force and its capability to do so in a distributed battlespace or area of operations. At the heart of being able to do so is to have C2/ISR systems operating on platforms which allow for synergy management, or the ability to provide for the connected tissue for platforms operating in an area of interest which can mix or match to work as an integrated force.

This means that if you are building a new platform which is being designed from the outset to be a player in this new world, then the nature of how to build out that capability is crucial. When considering new build platforms, integratability is a key consideration in terms of how to design, and build-in much more rapid upgrades but modernization which works towards enhanced integratability, rather than stove piped cacophony.

And for the OPV team working in the Australian Department of Defence, the clear commitment is to work the combat, C2 and mission systems as an ongoing enterprise not just on a particular platform but force wide. But what does it mean to be a supplier to such an effort in which the prime contractor is tasked to deliver ongoing capabilities and contribute those capabilities across the force, rather than to provide simply capabilities defined solely by a single platform?

Vice Admiral (retired) Barrett Speaks At The Williams Foundation Conference, October 2019

"... A NEW APPROACH TO PRIME CONTRACTING ..."

Rather than a prime contractor working the integration of systems platform by platform, the Australian Department of Defence is working with a new model, one in which the prime contractor works with suppliers which will reach beyond the platform on which they are operating, for which the prime contractor is primarily responsible.

This is a whole new world, but one designed to achieve what Vice Admiral (Retired) Barrett calls a new approach to prime contracting.

"*We see new shipyard capabilities and new industrial partnerships being forged to build a new approach to shipbuilding.*

"It is being done with a new approach which is not just focusing on a traditional prime contractor method of building the hull and having the systems targeting that specific platform.

"It is about building a sovereign capability for our combat systems so that we can upgrade our systems onboard this class and all future classes of Australian ships.

"The OPV is providing some concrete manifestations of what we set out to do.

"It should be the marker for what follows in the continuous shipbuilding program."

A new approach provides new challenges and opportunities for the defense industry.

L3HARRIS AUSTRALIA:
WORKING AS PART OF TEAM LUERSSEN

On January 6, 2020, Managing Director, L3Harris Australia, Nigel Bagster, SA Premier Steven Marshal, and L3Harris Maritime opened a new Adelaide office to support Australian shipbuilding programs.

During my March 2020 visit to Australia, I had a chance to talk with Rob Slaven, a former Royal Australian Navy Captain, now with L3Harris, about how one might answer this question. I started by asking about what systems L3Harris was providing for the Arafura Class OPV program and in highlighting their contribution, he underscored the significance of providing an integrated electronic system for the program.

Rob Slaven: *We are working with Luerssen Australia to deliver what has traditionally been thought of as three separate systems onboard the ship: An Integrated Navigation System (INS); an Integrated Communications System (ICS); and an Integrated Platform Management System (IPMS). Collectively this suite of systems is known as the "Integrated Electronic System" of IES.*

"Whereas in the past these systems would have been delivered separately in a stove-piped fashion, the Commonwealth's focus on holistic integration and digital, software definable systems onboard the ship, allows L3Harris to design and code a single IES capability.

"Marrying different system elements, and drawing upon disparate business units, we are able to deliver a hardware agnostic coherent capability to the customer.

"With the OPV we have woven these three different systems into what is in effect a single integrated system, because once you get the design and cabling right, integration becomes a matter of coded interfaces and compatible data sets, controlled by some very smart software.

"With the combination of common interfaces, adaptable software applications, fast computer servers and fiber optic cabling, we can share data across those three systems, enabling better systemic control and facilitating predictive maintenance in a manner Navy has not experienced before.

"The effective (seamless) exchange of data among these systems is what will make the OPVs better ships than everything that has come before them, and they will offer the Commonwealth the operational flexibility and improved availability that they are looking for.

"The IES approach allows for shipboard data integration and pooling, or disaggregation as desired. With the IES for example, one could measure the performance data of a pump controlling the steering and send that data ashore to someone in Perth to better assess ship and Class performance, and then plan appropriate maintenance activities tailored to that systems measured data.

"With the OPV, Defence will be able to manage the force in a deliberate and planned manner, leveraging the IES to interrogate 'platform' performance without having to having to resort to the labour intensive interrogation of stovepiped systems.

"Bottom line: As long as you get the IES design right – i.e. the wiring, the interfaces, the cyber protections and control software - one can seamlessly exchange data across different system types, and then tailor system outputs as desired for the specific applications, or indeed, modify overall system configuration and performance as required should the ship's tasking change while on patrol.

The Impact of an Integrated Systems Approach

Question: What the integrated systems approach is delivering then is a smaller footprint onboard the ship, an easier software upgrade path to evolve capabilities or modernization paths over time.

This then changes what the role of systems supplier like L3Harris plays with regard to a new build platform?

Rob Slaven: It does.

"With an integrated systems approach, as long as the computer environment (server) is fast enough, then most functions can be virtualised and become an application running on a computer.

"Simplistically, if you have a flat screen touch displays connected to an integrated environment, then that display can switch functionality at will across system functions. Technologically speaking, there's nothing to stop the same display being used for navigational and engine control. It's just a multifunction display, albeit a display backed by a well-designed integration effort and the inherent flexibility of software code.

"With the move to virtualised machines, we are changing the way and speed at which upgrades can be implemented, as it's effectively just a software application.

"With the flexibility of software upgrades, capability improvements can be delivered to ships at sea while underway if required or desirable, and they can be rolled out very regularly in a non-intrusive manner.

"This sort of operational and sustainment flexibility flattens out many of the logistical bumps Navy has faced in the past, and will again demonstrate how the OPVs will change the way Navy and CASG can do business going forward.

"As part of this new integrated platform paradigm, Luerssen as the OPV platform Prime, is delivering a design which is digitally fluid and able to morph as required to meet changing operational requirements, accommodate emergent technologies (either fitted or via embarked payloads) versatility, or facilitate the implementation of new training and sustainment methodologies.

"That is to say, the OPVs will be able to offer unheralded platform and capability flexibility in comparison to the ships they are replacing.

"The digital design flexibility of the OPV is such that if by the time we get to ship seven, a sailor on 'ship three' has found a better way of doing business on one of the systems, and he convinces the Navy that that is the way they want to do it, then we can code up a software modification, prove it ashore on its digital twin, and roll out a configuration change and training package that can bring all of those seven ships and crews to the same operational configuration simultaneously.

"In a worst-case scenario, if due to the Batch build approach, the physical configurations of the computer servers onboard the first three OPVs are not powerful-enough to run a system for whatever reason, then those ships would require a physical server upgrade before running the new code.

"But again, once you make that computer hardware change, then all seven ships will again share the same configuration and the same capability. The widespread adoption of virtualised functionality and common interfaces means that we can create a "hardware agnostic" approach to shipboard system operation.

"Indeed, as long as the Human-Machine Interface remains the same/similar across hardware/software upgrades, then we can help Navy avoid many of the personnel management pitfalls associated with retraining operators.

"Over the life of the OPV build program there might be longer term physical design changes to the hull like a bigger crane or a bigger boat, or a smaller flight deck etc.

"But for something that is software defined like the communication suite, then "change" becomes a matter of managing the pace of software upgrades, with a commensurate impost on the Commonwealth's governance systems to certify and accredit those new software loads.

"Although this sounds like a new loading on the Commonwealth, it really reflects a technologically driven move toward a software "seaworthiness" certification regime, rather than looking at a set of drawings associated with a new piece of radio or crypto equipment.

"Some of the work we are doing with the United States Navy reflects a potential regime wherein software can be coded and rolled out to ships underway within 24 hours – dependent upon what is happening operationally, and what demands/loads/threats are being placed onto the integrated system.

Delivering an Integrated Warfare Suite

Question: When we are talking about the C2 capabilities on the ship, we are not just talking about legacy C2, but we are talking about a communications suite or synergy management if we focus on the broader capabilities. How do you view this key part of the transformation being generated by the approach being shaped onboard the OPV?

Rob Slaven: "Suite" is the right term.

"The traditional terminology usually focuses on the functionality of C2 systems, because this is how isolated function specific systems were developed and it how these systems have historically been contracted for on platforms.

"But really, what we are focused upon with regard to the OPV, is designing the IES to shape a capability outcome, namely, creating a shipboard electronics environment that delivers an Integrated Warfare Suite (IWS).

"L3Harris can only really 'integrate' the systems we've been contracted to, but because of the Team Luerssen construct, we're working closely with Saab Australia who are providing the core Situational Awareness System C2 elements.

"What we're physically designing are the three elements of the OPV IWS that we control, which includes both hardware and software engineering.

"With the OPV we're providing a platform that is electronically able, and informationally ready, to swap and exchange data among different aspects of the actual physical ship systems quite freely.

"This means that whatever applications that the Commonwealth decides to code into the C2 system,

on board, the IES and C2 system can collectively integrate those disparate data sets organically on the ship, and reach out to external platforms to mate those sensors/data sets into a collective/coherent C2 picture.

''Let me give you an example which can be realized in the near term.

''If an operator in the ship's Operations Room on the OPV wants to launch an Unmanned Underwater Vehicle (UUV), they should be able to press a button on their Saab C2 display, and that command will be translated and communicated within the IES to order the autonomous launch of the UUV.

''With the ability to preload/reprogram UUVs with their mission profiles, the IPMS can then take control of the autonomous launch and recovery system to put that UUV in the water, and it goes away.

''And dependent upon the amount of freedom designed into the UUV, there would also be the capacity to reprogram the UUV after launch – all from the OPV's Ops Room.''

The Impact of the Cognitive Engine

Rob Slaven: ''And this is the really smart bit, L3Harris is developing a Cognitive Engine (CE) that resides within the communications management system, which can interrogate the EMS, interpret extant Communication Plans, and cognitively assess the TACSIT, i.e. work with defined rules/doctrine, to identify suitable communication channels to facilitate executing the mission task without further operator interaction.

''The Cognitive Engine is creating the communications pathway necessary to support that UUV and what it needs to do in real-time. It is an autonomous machine to machine link that comprehends the physical and tactical environment.

''The cognitive engine is using the ship sensors, specifically the communication antenna farm and the EW system and, if we're allowed, the radar faces, to measure the environment in real-time, to measure what the environment and adversary are affecting viable EMS transmission routes, and then determine which communications channels are available in accordance with its programmed doctrine.

''In effect the CE is looking at the environment, comparing it to the operational requirements, and execu executing mission tasks without operator input at Machine Speed.''

Question: How is this done?

Slaven: So it's a matter of trust.

''You define for the cognitive engine what it's its functions are, and the operational rules it must operate within. You give it physical guidelines and system configuration restrictions to control.

''You give it access to antenna arrays to measure the environment. And then you let it go. The CE will execute the mission as defined within its parameters. The USN's Aegis system already has something like this referred to as "Doctrine". Which USN operators plan and develop specifically for that deployment's operational profile in the six months prior to sailing. When/if the operators turn that Aegis system on, it's going to execute all of those planning rules in the established doctrine).

''OPV sailors can/could still interact and change actions/operations as required during the deployment, however the goal is to entrust the CE to execute the communications battle plan at Machine Speed to defeat enemy actions.

''L3Harris is currently trialing cognitive technologies with the USN for the communications suite, wherein we've got a cognitive engine with a given set of doctrinal controls, and we're allowing it access to the communications and EW antenna farms to measure the EM environment.

''Happily I can report that the system has done everything we expected and more, with the CE reconfiguring the communications plan in real time to execute the mission profile as allowed by the doctrine. Indeed, the trials have gone so well we have taken the next step toward allowing the CE to interpret "Commanders Intent", a much more 'fuzzy' form of doctrinal guidance.''

The New Build OPV Approach as a Driver for Change

Question: And it is the OPV which is doing this?

Rob Slaven: The IES design will allow for this CE functionality. And although the OPV is not a sexy destroyer or frigate; and it is not a massive command platform like the LHDs; nor is a sneaky submarine. It will in its

own right become the focus of its own fleet of unmanned systems, and become a central communications node/hub as part of the wider Joint force.

"If you design the ship right from the outset, and provide flexible, Integrateable systems, with open agreed interfaces, you create very different approaches to systems development, modernization pathways and sustainment management.

"Currently, the only things holding back the OPV from CE operations will be a software load, apart of course from the integration of a EW suite, embarked UxV payload systems, and of course trust from operators.

"While we can't address the first two of these additional requirements, the latter matter of trust is more a human generational issue, with today's/tomorrow's sailors far more familiar with the capabilities and possibilities of technology than their forebears.

"The Royal Australian Navy is looking toward an enterprise approach for operations and sustainment, and clearly the OPV is being designed and built with this approach at its core.

"The Navy is looking to shape a shipboard technology environment with shared interfaces that can allow all the systems to talk together in a cyber-safe manner, and where we can finally break away from systems-specific barriers and silos. From our perspective, the OPV is clearly viewed by the RAN as the launch platform for this new approach.

"Because the OPV is such a different type of platform it will be groundbreaking, and the Royal Australian Navy should justifiably be proud of their new ships.

"Not only will the RAN be able to show the OPVs off to the world, but it will also be able to show itself what smart design and technology can do to break long standing operational and sustainment paradigms.

"These ships, these OPVs, will be a superior communications and electronics platform from everything that has come before them. Of that there is no doubt in my mind.

"The OPV will be able to take data from a multitude of other platforms and systems, and use holistically use that collective data to execute the mission, as opposed to the stovepiped traditional design thinking that defines even the Navy's latest destroyer.

"From L3Harris's point of view, we are focused on demonstrating the advantages of this IES capability, because we are sure that the OPV is going to be better than that

destroyer as far as being able to collect, measure and exchange information.

"On operations, the destroyers will be going to the OPVs to build their picture, control UxVs, and get their critical tactical information out in a denied environment.

"That level of capability is going to break paradigms and shock people in the Royal Australian Navy, it's going to shock the New Zealanders, the Canadians, the Brits, the Americans, the Germans, and the French.

"It's going to shock everybody, because suddenly this OPV is showing everyone the new way to do business.

"Although physically just a 'little' OPV, it's going to be doing the job of what traditionally people thought larger command assets do.

"It will command and operate its own Air Wing, its own UUV force, its own dispersed USV screen.

"The OPVs will enable and facilitate change in a fashion the Navy has not seen since the introduction of wireless RF.

"If people looked at the way we're delivering the OPV IES capability, I think they'll be pleasantly surprised and be able to take a lot of lessons learned about what we're doing as a part of Team Luerssen, that is, as an Australian Industry team.

"We are not only delivering a whole new level of operational capability to the Navy, but we are setting the standard for local 'teaming' to deliver on the Government's National Shipbuilding Strategy.

"Team Luerssen is the little team that can."

The first time I met Vice Admiral (Retired) Tim Barrett was at the 2016 Williams Foundation Seminar in which he addressed the evolving role of the Australian Navy in the transformation of the Australian Defence Force. He provided a keynote presentation to the August 2016 Seminar on new approaches to air-sea integration.

His presentation at the Seminar presaged why the new Offshore Patrol Vessel was destined to be a launch platform to the new integrated distributed approach.

Barrett made it very clear that what was crucial for the Navy was to design from the ground up any new ships to be core participants in the force transformation process underway.

In his presentation at the conference, he underscored that "*we are not building an interoperable navy; we are building an integrated force for the Australian Defence Force.*"

He drove home the point that ADF integration was crucial in order for the ADF to support government objectives in the region and beyond and to provide for a force capable of decisive lethality.

By so doing, Australia would have a force equally useful in coalition operations in which distributed lethality was the operational objective. He noted that it is not about massing force in a classic sense; it is about shaping a force, which can maximize the adversary's vulnerabilities while reducing our own.

The recapitalisation effort was a "*watershed opportunity for the Australian Navy.*" But he saw it as a watershed opportunity, not so much in terms of simply building new platforms, but the right ones. And with regard to the right ones, he had in mind, ships built from the ground up which could be interoperable with JSF, P-8, Growler, Wedgetail and other joint assets.

"*We need to achieve the force supremacy inherent in each of these platforms but we can do that only by shaping integrated ways to operate.*"

He highlighted that the Navy was in the process

> " ... A WATERSHED OPPORTUNITY FOR THE AUSTRALIAN NAVY ... "

of shaping a 21st century task force concept appropriate to a strategy of distributed lethality and operations.

A key element of the new approach is how platforms will interact with one another in distributed strike and defensive operations, such as the ability to cue weapons across a task force.

In the interview after his presentation which I did with him, he highlighted key elements which can be seen in play as the Commonwealth builds a new class of ships.

"*I am taking a very long view, and believe that we need to build our ships in Australia to generate naval capabilities integrated within the ADF.*

"*We need agility in the process of changing ships through life—continuing to evolve the new ships depending on how the threat is evolving.*

"*This means that we need to control the combat system software as well as build the hulls. We will change the combat system and the software many times in the life of that ship; whereas, the hull, machinery in the plant doesn't. That might sound like a statement of the obvious.*

"*But it's not a statement that's readily understood by our industry here in Australia.*

"*We need to organise ourselves to have an effective parent navy capability.*

"*We need to manage commonality across the various ship build processes.*

"*That will not happen if we build someone else's ship in Australia which is designed to operate in separate classes.*

"*I don't want an individual class to be considered in isolation. I want to cross-learn and cross-operate throughout our various classes of ships, and notably with regard to software integration and development.*"

THE IMPACT OF THE ARAFURA CLASS OFFSHORE PATROL VESSEL

THE PERSPECTIVE OF VICE ADMIRAL (RETIRED) TIM BARRETT

After my visit to the Henderson shipyard, I had a chance to talk with Vice Admiral (Retired) Barrett about his perspective on the OPV program as the building block for the template for change for the ADF and the Royal Australian Navy in shaping a way ahead to an integrated distributed force.

Question: How important is the OPV to the approach you identified and put in motion while you were Chief of Navy?

Vice Admiral (Retired) Barrett: It is an extremely important demonstration of what was, at the time, an idea and a prospect for future development of our navy.

"We see new shipyard capabilities and new industrial partnerships being forged to build a new approach to shipbuilding.

"It is being done with a new approach which is not just focusing on a traditional prime contractor method of building the hull and having the systems targeting that specific platform.

"It is about building a sovereign capability for our combat systems so that we can upgrade our systems onboard this class and all future classes of Australian ships.

"The OPV is providing some concrete manifestations of what we set out to do. It should be the marker for what follows in the continuous shipbuilding program.

Question: My discussion with the OPV team working in the Department of Defence highlighted their approach to dual tracking the platform build from the management of the combat systems build.

And they highlighted the importance of being able to leverage the combat systems build in the OPV program and take this forward into the design and build processes for the next round of new build platforms.

How do you view this effort?

Vice Admiral (Retired) Barrett: In my view, this approach is quite profound. We have had a history building propriety ships with their associated combat systems. We have managed the combat systems within a particular platform only.

"Government made a clear decision with its new shipbuilding

approach, to manage the combat system as a separate entity. The principle role of the ship going to sea is to manage the combat system. The Commonwealth team for the OPV is the first manifestation of this new approach.

"It is a sensible outcome which shows that you are managing the asset as warfighting component of a distributed, and interconnected system, rather than purely managing an individual combat asset or class.

"I am very keen to see this approach expressed by the Commonwealth team."

Question: Is a primary goal to take this OPV build and management process forward to the other new build programs?

Vice Admiral (Retired) Barrett: It is. The speed and the pace with which combat systems and associated capabilities are evolving clearly requires a new approach. You need to be adaptive and to make required changes rapidly.

"In effect, you have to design into your warship build approach a way to be rapidly adaptable rather than figuring out later how in fact you will adapt.

"What we have with the OPV is the ability to shape it to operate in a number of different ways, including operating maritime remotes across the operational space. Rather than simply building a hull form to do classic constabulary tasks, we are building a ship which is capable of being morphed into a variety of missions with an extended operational combat or gray zone space.

"It is an experimental process not only in terms of build but in terms of the mission systems management process.

"This is a significant shift from how the Commonwealth has bought combat systems in the past. The proof is still to be manifested in the work to be done."

Question: The ship is clearly going to operate in the gray zone as people refer to it. How do you view this challenge?

Vice Admiral (Retired) Barrett: With an emphasis on distributed lethality, then every vessel you send to sea has a part to play. The OPV is being built with this approach in mind.

"While the combat system onboard the OPV will be less complex than an Air Warfare Destroyer, it needs to contribute to the broader distributed integrated force.

"And we are talking about the ability of the Air Force and Navy to work together through the integrated approach to deliver capabilities for the common mission the force will be focused on achieving in a crisis management situation."

Question: The OPV is being birthed in an age where maritime remotes are coming to the force and will become more significant over its life cycle.

How do you see the role of the OPV in this process?

Vice Admiral (Retired) Barrett: The ship has been designed from the outset to operate airborne unmanned systems as well as trusted autonomous maritime systems.

"It is being designed to be able to work with unmanned systems and AI-governed remotes as part of its extended reach into the operational space.

"Fundamental decisions were made early on with regard to how the vessel would be built that it could physically host and manage to handle a variety of unmanned systems."

Question: In effect, it is crucial to have a C2 suite or a synergy management system onboard the OPV to be able to work the variety of systems onboard but highly interactive with other platforms with interactive capabilities.

How do you view this process?

Vice Admiral (Retired) Barrett: "This ship was conceived at a time when we were looking at the rise of autonomous systems but in the context of an ability to do synergy management.

"This is why we look at the OPV as part of the evolving integrated force whereby its data is part of the broader whole.

Question: What are the major challenges facing this overall approach?

Vice Admiral (Retired) Barrett: It is a significant change in thinking. We live in a world where there are rapidly changing demands on our military forces.

"We have no real alternative but to find ways to more rapidly adapt our combat and mission systems.

"The approach to the OPV is a step in this direction but will challenge legacy thinking in industry, in the forces and in government.

"The enterprise approach we have taken is designed to enhance the prospects for success.

"Clearly, change is required by industry, the government and the navy to shape a new approach.

"But new capabilities, digital shipbuilding, asset data management, and upgradeable combat systems which can share approaches across platforms, provide us with some of the tools to shape, execute and management a continuous shipbuilding process."

THE IMPACT OF THE ARAFURA CLASS OFFSHORE PATROL VESSEL ON ADF TRANSFORMATION

THE PERSPECTIVE OF AIR MARSHAL (RETIRED) GEOFF BROWN

The journey from focusing on F-35 and its impact to the launch of a new build offshore patrol vessel seems a long one, but shorted by the evolving role of C2/ISR transformation and the reshaping of the ADF to become an integrated force able to operate across the full spectrum of crisis management.

On the day of my departure from Canberra at the end of my March 2020 visit, I was able to meet with the Chairman of the Williams Foundation, and to get his perspective on why a journey from F-35 to the Arafura Class Offshore patrol vessel made sense.

“If you look at the whole fifth generational approach that we’re trying to do, this is the first new build that we’ve had from Navy, since we looked at that entire, integrated domain approach.

“It comes before the frigates and before the new build submarines. If we get a lot of the basics right on the OPV, we can flow those successes across to the other two platforms as they develop. I think from the perspective, both of an integrated domain approach and from the perspective of the flow through to the next two build platforms, not enough credit is being provided to the OPV program and its efforts.

> "... WE NEED MORE OF A FALLON-TYPE TRAINING FOCUS, WHEREBY NOT ONLY THE SURFACE SHIP, MANNED AND UNMANNED SYSTEMS, SIMULATE AND TRAIN TOGETHER, BUT THE MANNED AND UNMANNED AIR ASSETS AS WELL ..."

Question: Although challenges clearly are to be had, and problems encountered, the point is that these will be going a path in the right direction.

And it is important to consider that the ship is being born in the era of integrated distributed operations, gray zone operations and autonomous operations.

How do you view the context in which the ship is being birthed, so to speak?

Air Marshal (Retired) Brown: "The ship needs to be flexible enough to operate throughout the spectrum of conflict. It needs to be able to excel at its bread and butter jobs, a core one being to meet the needs of the maritime border command.

"But it also needs to be a platform which can contribute to the higher-end operational environments, and to do operate in such a manner is not an easy challenge to meet.

"And as you pointed out, the vessel is being shaped to operate unmanned systems.

"Especially for small forces, like the ADF, there is an enormous opportunity to develop and operate AI driven remote platforms, for in so doing you can bulk out the force and to do so in ways that we have not thought about before.

Question: You have focused a significant amount of your recent work on the training challenges for a fifth-generation force.

How do you see the OPV in this light?

Air Marshal (Retired) Brown: With regard to training, for mission success, one cannot focus simply on the training inside the ship or to train for basic ship functions.

"If one were to do that, one would miss too many opportunities being provided by the ship's mission and C2 systems, and their contribution to the ADF overall.

"We need to be able to simulate and train to the entire domain the OPV is going to operate within. We need more of a Fallon-type training focus, whereby not only the surface ship, manned and unmanned systems, simulate and train together, but the manned and unmanned air assets as well.

"The coming of the OPV provides an entry platform and capability into that new training world. We need to build a training center that can be modular, and increased in size, as the new capabilities within the fleet and the Air Force come online.

In short, there is a need to have both a virtual ship environment to develop the core skills to operate the ship, but to be able to put that ship into the evolving integrated environment.

Such training would allow operators of the various key platforms to become comfortable working together and knowledgeable about the evolving capabilities on platforms other than their own which they will call on to provide reachback for their own mission success or to which they will need to contribute to another player in the battlespace.

THE CONTRIBUTION OF THE AUSTRALIAN ARAFURA CLASS OFFSHORE PATROL VESSEL TO SMART SOVEREIGNTY

The new build Australian OPV program is shaping a new template for Australian shipbuilding. And it is one in which the role of the prime contractor is being redefined and in which the Commonwealth is shaping new governance structures for managing the effort, in terms of working the platform and mission systems management separately but interactively.

This new template is a work in progress and it will be challenging to execute fully.

I had a chance to discuss the importance of this strategic shift for Australia with Vice Admiral (Retired) Chris Ritchie, former head of the Royal Australian Navy. He has had a distinguished career as well in the private sector. From 2009 through 2012, he was Chairman of the Board of Directors of submarine and ship builders ASC Pty Ltd. In that position, he saw first-hand the challenges of the traditional approach to Australian shipbuilding which has been defined by the legacy approach to shipbuilding: one off builds, pause, and then reload for the next one-off build. He was Chairman as the Air Warfare Destroyer build was put in motion, which is a major addition to not only the Royal Australian Navy but to ADF transformation overall. He is currently a director of Luerssen Australia, prime contractor for the Australian OPV build.

In a 2017 piece in the Australian Business Review, Ritchie highlighted why he thought the OPV program was so critical to Australia's maritime future.

"At the Australian Strategic Policy Institute last month, Defence Industry Minister Christopher Pyne outlined his long-term vision to turn Australia into a defence exports powerhouse. This vision is supported in large part by the requirements and opportunities contained in the federal government's Naval Shipbuilding Plan.

What many people outside Defence do not understand — and why should they — is that the success of this vision will to a large extent depend on a comparatively unknown shipbuilding program known as SEA1180, and the decisions the government is expected to make around its delivery in the next few months.

Under SEA1180, or the Offshore Patrol Vessel Project as it is also known, 12 steel-hulled patrol boats will be built to replace the Royal Australian Navy's ageing fleet of aluminium-hulled Armidale-class vessels. The first two of the new offshore patrol vessels will be built in South Australia and the following 10 in Western Australia.

The $3 billion Offshore Patrol Vessel Project will be the first major domestic steel-hulled shipbuilding project in the government's continuous shipbuilding program.

This means the Offshore Patrol Vessel project will carry the weighty responsibility of recruiting and training the next generation of naval shipyard workers in this country.

The newest cohort of young Australian engineers, designers, welders, structural fabricators and electricians will be recruited and trained to build the offshore patrol vessels.

They will form the vanguard of a naval shipbuilding workforce that, all going to plan, will go on to build our new submarine and frigate capabilities, and meet the emerging demand in our region for minor warship exports.

In simple terms, the Offshore Patrol Vessel project is the pilot light required to get the entire Australian domestic naval shipbuilding furnace going. It will also begin to develop the industrial base Australia needs if it is to make good on the government's aspirations to compete in the global — and rapidly growing — marketplace for naval exports."

In our discussion conducted on March 30, 2020 via telephone, we discussed why and how the OPV program is a template for change.

I will not quote him directly, but I had several takeaways from our conversation which reinforced what I have learned over the past three years and underscored by my visit to the Henderson shipyard and meetings with Luerssen and CIVMAC.

The first takeaway was that Australians needed to build a relevant defense industrial base to support the way ahead for the Royal Australian Navy.

But such an approach needed to shape something different from the United States or the European allies. Australia has a smaller pool of skilled workers, and a smaller population.

So how best to do this?

The second takeaway was the new build OPV with a focus on sovereign management and control over the combat and mission systems was a way ahead.

Such an approach would allow Australia to work closely with a variety of key allies and to build the intellectual capital crucial to the development of the combat skills and systems which Australia needed, but also for which it could credibly build a skilled higher end work force to support.

The third takeaway was that the Commonwealth was looking to shape a very different working relationship with industry.

A requirements-based adversarial relationship where the Commonwealth was interacting with industry largely to shape and enforce requirements was not going to get Australia to the new approach it needed.

A shift would happen only with shaping a new partnership with industry and reshaping how to work with a prime contractor who understood the new approach.

The fourth takeaway was the importance of the

emergence of the partnership which I witnessed in West Australia.

Clearly, Luerssen gets it with regard to the kind of partnership which Australia is working for. Because they are not trying to build as much as they can in Germany in order to create jobs in Germany but are focused on how to stand up a new Australian company and working design capabilities interactively between Australia and Germany, Luerssen fits the needs of Australia looking for a new partnership approach.

The fifth takeaway involves the question of exports.

The intellectual capital being generated in Australia to build, evolve, and maintain the new OPV is where exportability will come from. It may or may not come from a hull export from Australia to an export partner but certainly the core mission systems and operational experience working maritime remotes and innovations to be able to do so are part of the export potential of the program.

The sixth takeaway with regard to exportability is it interaction with working with allies in the region.

Clearly, being interoperable with nations operating OPVs and similar vessels in Maritime Border Command and related missions is a key aspect of being effective in the region.

If Australia can export part of its intellectual capital to shape integratability within the ADF, this puts them in a position to work with other allies in the region to hook such integrability into fleet operations and thereby delivering interoperability.

The seventh takeaway is the growing importance of self-reliance for Australia.

My observation from my visits of the past several years to Australia is a clear shift in thinking about the need for greater resilience in Australia itself to deal with global shocks.

Obviously, the current Coronavirus approach only underscores this concern. John Blackburn refers to this as the need for smart sovereignty.

"*When we redesign our supply chains, we need to pursue a "Smart Sovereignty" model. The scale or degree of sovereign capability you have in a country, will vary significantly country by country. A country the size of U.S., with its population and manufacturing capacity, will have a greater degree of sovereign capability.*

"A country like Australia, with much smaller population and a different economic base will have a smaller degree of sovereignty, but we need a lot more than we have right now."

And David Beaumont, a well regarded Australian logistics expert and serving Australian Army officer, has highlighted the importance for both Australian civil society and its defense sector to have more robust capacity to provide for its own needs in a crisis.

"*Defence industry policy and other Acts of government can be the bedrock upon which national security responses can be formed.*

"It may be that at the end of the COVID-19 pandemic, and after the economic recovery erases our memory of the cost of seizing international trade, behaviours and the interests of military and other national security organisations will return to normal.

"Now, amid a pandemic, it seems incredulous to suggest life will be so kind. National security is fundamentally about the preservation of normality, and militaries will have an important role in assisting their society assure it.

"It is an unwritten rule of military logistics start preparing for the time in which forces will return home just as they arrive on a military operation.

"Perhaps it is time to start planning now for 'what comes next', and to reconsider the national security implications of the globalised international economy."

The OPV template could provide an important stimulus to shaping a practical way ahead to achieve such a new approach.

In this sense, the OPV project could provide a measured manufacturing response that provides a path ahead for the nation.

In other words, it not is just about a new approach to shipbuilding, it can also trigger serious rethinking as well as shaping new approaches for smart sovereignty.

In my visit Western Australia, I visited both the Henderson shipyard and HMAS Stirling, the Collins submarine base.

These visits when combined with earlier visits with the Royal Australian Navy in Sydney and in Adelaide have provided an opportunity to look at the real-world aspect of reshaping the Australian Navy as part of the ADF's transformation.

In various visits to Canberra over the past six years, I have had the chance to talk with many civilians and uniformed military about the launch of the new "continuous shipbuilding" approach. This approach is how the Commonwealth is shaping its way ahead in building the three new classes of ships, the Offshore Patrol Vessels, the ASW frigates, and the new attack submarine.

In all three cases, the Australians are working with European primes to build the new class of ships, but with American combat systems as the integrative force throughout the entire fleet. The Aegis system is a key thread throughout the surface fleet. And the OPV will use a Saab 9LV derivative which will be the Australian tactical interface that will allow it to talk to the Aegis based combat management system in the major surface combatants.

There clearly is significant debate about the way ahead with the new build attack submarines, but my focus here is upon what I see as the convergent expectations, pressures, and forces that shape Commonwealth and Royal Australian Navy expectations about what the new attack submarine will need to deliver in the future to align with the experience of the OPV build and integration process.

THE AUSTRALIAN ARAFURA CLASS OFFSHORE PATROL VESSEL: A TEMPLATE FOR THE FUTURE?

THE NEW BUILD ATTACK SUBMARINE: CONVERGENT FORCES AND EXPECTATIONS

The first is obvious at Henderson shipyard.

The OPV is establishing a template for what the Aussies mean by continuous shipbuilding. The digital build process coupled with industry 4.0 management and integration processes are clearly being put in place by the LUERSSEN Australian team.

And the template being shaped in this program lays down the foundation of what is expected or the launch point from which shipbuilding in Australia needs to look like going forward. This means that the Naval Group team needs to pay close attention to what the OPV build process will deliver.

The second key aspect is the evolution of Collins operations and capabilities over the next decade and a half. Although this is a legacy platform, the combat capabilities and experience are not. The Collins submarine force with its combat systems which allow for integration with the US Navy and other key allies is part of the evolving distributed maritime force being shaped for full spectrum crisis management in the Pacific.

Lessons to be learned will be taken forward to the new class of attack submarines, with an expectation that the capabilities onboard the evolving Collins will be enhanced by new shipboard infrastructure onboard the new Short Fin Barracuda.

To give one example, U.S. nuclear

submarines have different capabilities and con-ops from the Collins, but the Collins delivers a number of capabilities which a nuclear attack submarine is not optimized to perform.

In an era where new C2 capabilities are being shaped to better integrate the undersea force into an integrated air-sea naval force, these capabilities which will be shaped in the decade ahead will require skill sets on Collins which will be transferred to the new build attack submarine.

A third key aspect is infrastructure.

A challenge which Collins posed for the Royal Australian Navy clearly has been to build the appropriate infrastructure, including training, to unlock the potential of the fleet.

As Vice Admiral (Retired) Barrett highlighted with regard to the strategic focus by the Navy on shaping a submarine enterprise and its importance going ahead:

"*In the last ten years of Collins capability management Navy has embraced the outcomes of the Coles Review that prompted an enterprise approach and fundamentally changed how the submarine force looked at Collins maintenance and availability.*

"*The result has been resounding turnaround in capability which has allowed much greater engagement with allied submarine forces and a more meaningful contribution to theatre ASW.*"

As Australia focuses on building up to 12 new submarines, new infrastructure clearly will have to be built, perhaps as well in the Eastern part of the country, and this build will be almost certainly largely Australian.

So when one is discussing the percentage of Australian content in the new submarine, it would make sense to expand the discussion to embrace the overall submarine enterprise.

The visit to Henderson was notable in terms of seeing what the joint venture partner of Luerssen, CIVMEC, has done from an infrastructure point of view.

A fourth key aspect is evolving approaches to fleet management.

It is clear from several discussions which I have had with the Royal Australian Navy and Department of Defence officials, that a significant effort is underway to establish much more effective fleet management situational awareness and tools for determining both platform availability as well combat effectiveness.

This requires the Australian Navy to shape data which flows from distinct platforms to be managed in ways that allow for much more effective common force would evaluations and determinations.

This means that by the time the new build submarine enters the force, there will be a clear expectation that its logistical and operational parameters will flow into a common management data base.

Or put another way, the Short Fin Barracuda is NOT a replacement for the Collins class.

It will enter the force as a key asset in the evolving integrated distributed force in which Collins may be a lega-

cy platform, but not the skill sets and systems which will have evolved over the next decade or more in front of the operation of the new submarine.

And the decade ahead will be a very demanding one, in terms both of how the threat evolves as well as the expectations of how to integrate distributed assets into an effective combat force tailored for crisis management. For submarines, this means more multi-mission capabilities will be built into the fleet, along with the evolution of the types of weapons which will be operated from the fleet or targeting determinations provided to other platforms to perform strike missions.

And here the new build OPV will have an impact as well. With the OPV operating as a mother ship and launching maritime remotes into the extended battlespace, they will be part of the new concept of what a wolfpack will be for the new build submarine, which itself will have maritime remotes onboard.

In effect, as the shaping and evolution of the distributed integrated force matures, the concept of a submarine wolfpack will emerge but very differently from the World War II concept. That wolfpack will include a variety of task force assets being directed at the point of crisis engagement or combat area. And will include not simply maritime assets, but air and land assets as well.

This experience of the fleet with maritime remotes operating from the OPV will precede the first deployments of the new build submarine but will form a clear set of expectations from the Royal Australian Navy concerning what the new class of submarines will need to deliver in terms of capability for the ADF as an integrated distributed force.

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For the past few years, I have been visiting Australia to participate in and to write the reports for the bi-annual seminars held by the Williams Foundation which focus on defense transformation by the ADF in a changing strategic environment. In the course of this work, it has become clear to me that the fundamental strategic shift facing Australian and allied forces is from the land wars being fought in uncontested air and maritime space to full spectrum crisis managing in very much contested air and maritime space.

And the key focus of trying to prevail in a full spectrum crisis management environment is building out a capability to operate a distributed force which is integratable through evolving C2/ISR capabilities.

In my view, as the liberal democracies build new platforms there is a clear need to build these platforms in such a way that they are designed from the ground up to be able to operate as an asset for a distributed force which can be scalable, integratable and tailorable to a crisis.

I view such an effort as the new Offshore Patrol Vessel in Australia. For me, the new build Australian Patrol Vessel is being launched in a strategic environment in which the liberal democracies are looking to reshape their capabilities to defend their interests in a world increasingly contested by the 21st century authoritarian powers.

And the nature of the strategic shift is from the land wars to a world in which the liberal democracies need to be competitive in a full spectrum crisis management.

Because the adversaries are building to mass and are emphasizing expansion of strike capabilities controlled by a very hierarchical command structure, the kind of force which will best fit Western interests and capabilities is clearly a distributed one.

Fortunately, the technology is already here

> " ... THE OPV IS NOT JUST A REPLACEMENT PLATFORM; IT IS A DOWN PAYMENT ON THE EVOLUTION OF THE NEXT GENERATION OF CRISIS MANAGEMENT CAPABILITIES... "

to build effectively down this path, a path which allows engagement at the low end and provides building blocks to higher end capabilities.

The force we need to build will have five key interactives capabilities:

- Enough platforms with allied and U.S. forces in mind to provide significant presence;
- a capability to maximize economy of force with that presence;
- scalability whereby the presence force can reach back if necessary, at the speed of light and receive combat reinforcements;
- an ability to tap into variable lethality capabilities appropriate to the mission or the threat in order to exercise dominance.
- and the ability to have the situational awareness relevant to proactive crisis management at the point of interest and to link the fluidity of local knowledge to appropriate tactical and strategic decisions.

What intrigues me about the Australian approach to building the new class of Offshore Patrol vessels is that will be their most numerous at sea presence asset. But the focus on upgradeable, scalable and integratable mission systems as the core of the effort, and one which is being designed from the outset to work across the fleet, provides an opportunity to shape capabilities for both reachback to other assets but to contribute to the force in new and innovative ways.

Setting a new template for building ships, and doing so with a core focus, on integratability, is a crucial step forward for the ADF. Certainly, such a template will be challenging to craft, execute and sustain in the period ahead. But building a new plat-

CONCLUSION

form with the integratable distributed force as the core outcome in mind puts the Royal Australian Navy down a new but crucial path.

But there are of course many challenges to succeeding. One is the nature of the platform itself. Most politicians, analysts and journalists focus on platforms; not integratability. Indeed, to the extent that the new C2/ISR capabilities evolve, it is proving difficult to grasp how different these capabilities are in their ability to reshape the tissue which can connect a force, and provide for distributed integratability.

What changes with the integrated distributed con ops approach is what a presence force can now mean. Historically, what a presence force is about what organically included within that presence force; now we are looking at reach or scalability of force.

We are now looking at economy of force whereby what is operating directly in the area of interest is part of distributed force. The presence force however small needs to be well integrated but not just in terms of itself but its ability to operate via C2 or ISR connectors to an enhanced capability.

But that enhanced capability needs to be deployed in order to be tailorable to the presence force and to provide enhanced lethality and effectiveness appropriate to the political action needed to be taken. This rests really on a significant rework of C2 in order for a distributed force to have the flexibility to operate not just within a limited geographical area but to expand its ability to operate by reaching beyond the geographical boundaries of what the organic presence force is capable of doing by itself.

This requires multi-domain SA – this is not about the intelligence community running its precious space- based assets and hoarding material.

This is about looking for the coming confrontation which could trigger a crisis and the SA capabilities airborne, at sea and on the ground would provide the most usable SA monitoring.

This is not "actionable intelligence." This is about shaping force domain knowledge about anticipation of events. This requires tailored force packaging and takes advantage of what the new military technologies and platforms can provide in terms of multi-domain delivery by a small force rather than a large air-sea-ground enterprise which can only fully function if unleashed in sequential waves.

With regard to the OPV, this means that a key part of the mission systems management package clearly is the SAAB C2 system and the capabilities which L3Harris is providing to that system and to the OPV as a capability. Normally, such systems would be seen as subordinate to the platform and be part of what a prime contractor would tailor to that particular platform.

But the shift means that such core capabilities will have their full impact and meaning only within a broader integratable context, whereby the OPV can operate as a single platform executing a mission or part of a wolfpack able to operate maritime remotes over an extended operational space.

The new build OPV is an example of the emergence of the new world where upgradeable mission systems, and C2/ISR fusion are becoming the dominant warfighting capabilities with the platform as the thing that carries these systems.

In short, the new build Australian OPV is not just a replacement platform; it is a down payment on the evolution of the next generation of crisis management capabilities.

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